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ABSTRACT

This monograph aims to provide teachers of grades 7, 8, and 9 with a variety of instructional activities and strategies that identify student difficulties in computing percents and teaching the skills needed for that cluster on the mathematics part of the New Jersey High School Proficiency Test (HSPT). Sections include: (1) "Concepts" (containing 10 activities with sample items from the HSPT and evaluation sheet); (2) "Computation Skills" (providing five activities with sample items and evaluation sheets); and (3) "Computation Applications" (presenting 12 activities with evaluation sheets). Each activity is accompanied by objectives, materials, procedures, extensions, and worksheets. Twenty references are listed. (YP)

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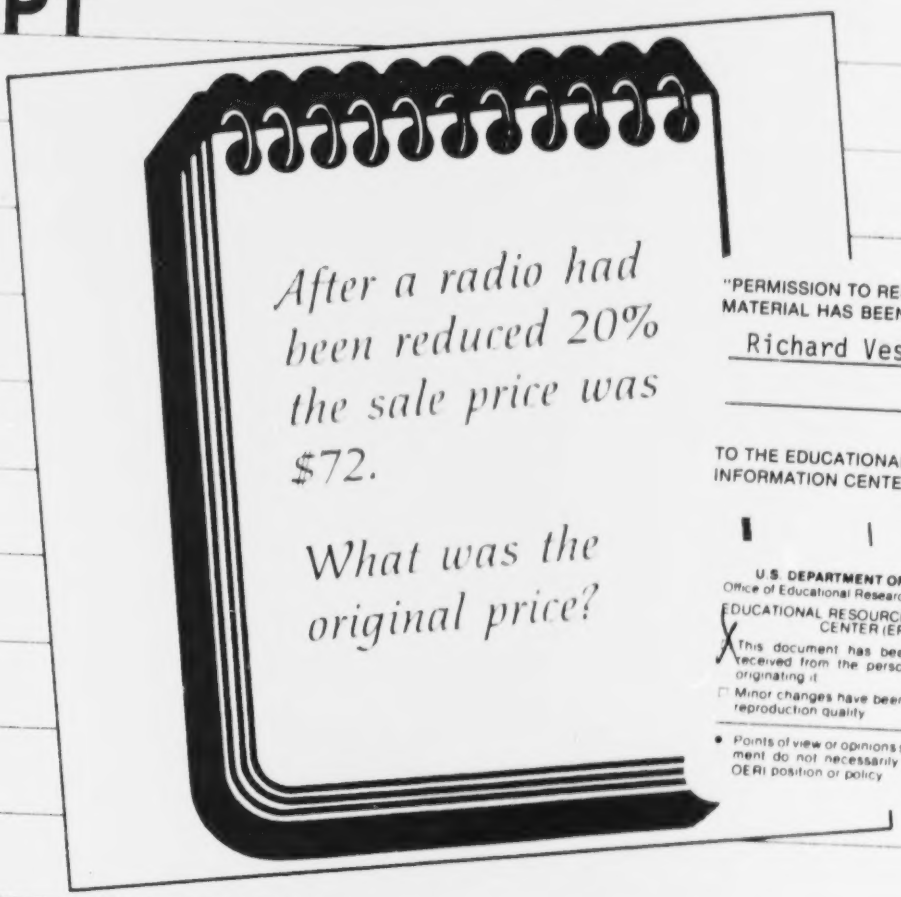
Improving Mathematical Skills Assessed on the HSPT



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Computation of Percents

TEACHING LEARNING TESTING

New Jersey Department of Education, Division of General Academic Education

SE 050 824

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IMPROVING MATHEMATICAL SKILLS

ASSESSED ON THE HIGH SCHOOL PROFICIENCY TEST:

COMPUTATION OF PERCENTS

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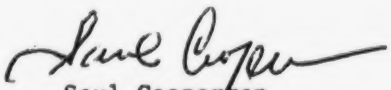
FOREWORD

The High School Proficiency Test (HSPT) is one way New Jersey is raising academic standards for public school students. The mathematics portion of the HSPT contains skills crucial for a productive citizenry. The achievement of students on the mathematics section of the HSPT, however, has concerned the educational community, parents, and the general public ever since the results were first reported in 1984.

One tested skill area in which students need to improve is that of computation of percents. On the 1984-85 HSPT, students had an average score of 61 percent on that cluster. In addition, student performance on word problems, which require both a comprehension of percent concepts and the percent calculations, was deficient. In both cases, this performance indicates that further instructional attention to the computation of percents is needed.

This monograph aims to provide teachers of grades seven, eight, and nine with a variety of instructional activities and strategies that promote understanding and improve performance in the computation of percents. The activities and strategies, which have been fieldtested in both urban and suburban environments, have the support of practitioners and researchers alike.

Teachers can adapt the activities described in this document to meet the specific needs of their students. Through participation in the training sessions offered at the three regional curriculum services units they can avail themselves of additional direction.



Saul Cooperman
Commissioner

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INTRODUCTION

This monograph, Computation of Percents, is for teachers of seventh-, eighth-, and ninth-grade mathematics students. Its purpose is to identify student difficulties in computing percents and to provide guidance for teaching the skills needed for that cluster on the mathematics part of the New Jersey High School Proficiency Test (HSPT). The content of this monograph is based on the HSPT Skill Array: Mathematics (1985) and the stated conditions used to construct test items. Test items from the HSPT Skill Array: Mathematics (1985) are presented here to serve as a reference for teachers planning instruction within the context of their current mathematics curriculum.

The mathematics section of the HSPT requires students to demonstrate computational ability in three related clusters: fractions, decimals, and percents. In additional clusters, the test requires students to apply these computational skills accurately to solve problems simulating real life experiences.

The concepts and applications of numbers, fractions, decimals, and percents have become increasingly important in our lives as workers and consumers. Much of the information that we must use to make decisions is stated in the form of fractions, decimals, and percents (e.g., salaries, purchases, credit). By the ninth grade, students should understand the relevant concepts, recognize the applications required by the word problems, and accurately perform the computations.

Recent studies (Post, 1981), however, indicate that most students have memorized computational algorithms without understanding the underlying concepts. This rote procedure leads to misapplication and misuse of the mathematics skill. A better understanding of abstract concepts evolves from the learner's experience with concrete models, manipulatives, pictorials, discussions, and written records. The learner must take an active part to develop and internalize an understanding of the abstract concepts. Empowered with that understanding, the student will be better able to make the necessary deductions in the use of the skill.

The major portion of this document consists of activities that will help students develop and master the concepts that form the basis for the skills they must demonstrate on the HSPT. These activities are suggestions, not prescriptions for the teacher. Different methods for computing percents are presented to afford maximum opportunity for instructional creativity. Section One includes activities for building percent concepts, and Section Two contains several activities that support the development of skills in computing percents. In the third and final section, activities are structured to support the concept and computation of percent in life-skill format. Worksheets are provided at the end of each section for evaluation of student performance. Teachers can use these to check on the effectiveness of instruction and to measure comprehension.

The materials presented here should be considered as a starting point. Teachers are encouraged to adapt the ideas and suggested activities to the needs of their students, as well as to add their own activities.

SECTION ONE

CONCEPTS

Concept Development For the Computation of Percent

The word "percent" comes from the Latin "per centum", meaning one one-hundredth part. Prior to 1957, the concept of percent was the major topic in the mathematics curriculum for grades seven and eight. With the advent of "modern mathematics", percent lost emphasis in some mathematics guides and textbooks (Smart, 1984) until the 1970's return to the "basics", which prompted its reincorporation into the curriculum guides. An Agenda For Action (National Council of Teachers of Mathematics, 1980) and Priorities In School Mathematics (National Council of Teachers of Mathematics, 1981) became the catalysts for a new focus on the instruction and application of percents. Many seventh- and eighth-grade textbooks, copyrighted 1981 to the present, now devote a chapter or an entire unit to the concept, computation, and application of percent. Students need to develop a sound conceptual framework before beginning formal computation procedures, so that computation is not simply rote exercises. The results of state and national testing indicate, however, that many students have not demonstrated a thorough understanding of percent concepts (Carpenter, 1982, 1983).

The activities in this section are designed to help create the necessary foundation for the concept of percent. The skill or skills addressed in each activity appear in bold in the upper right portion of the page. Not all of the activities that follow, however, are appropriate for all ability levels of instruction at grades seven, eight, and nine. Teacher judgment in applying and/or adapting the activities in this section and those offered throughout the monograph is necessary.

Curriculum Benchmarks at the Intermediate Grades (4-6)

In 1983 the New Jersey State Department of Education published Skill Arrays for the New Statewide Testing System. In that publication, the skills for the computation of percents are identified as curriculum benchmarks at the intermediate grade levels (4-6). As benchmark skills, they designate the foundation necessary for students to master the skills measured on the HSPT. The introduction of these skills at the intermediate grade levels (4-6), therefore, affords the sequential development necessary for sound mathematical thinking. The curriculum benchmarks identified here are important in the implementation of a broad-based curriculum. These skills are intended as a guide and not as an all-inclusive curriculum. They are:

1. converting percent to decimals,
2. finding a percent of a number,
3. finding the percent one number is of another number.

Although these benchmark skills are tested on the ninth-grade High School Proficiency Test, the activities in this document are appropriate reinforcement for the percent concepts presented and developed in the intermediate grades (4-6).

On the following page and by way of introduction, this section presents test items from the computation of percents clusters of the 1984 High School Proficiency Test. The test items and testing conditions are shown as they appear on the HSPT.

NOTE: The activities in this document call for the use of concrete models, manipulatives, pictorial displays, and worksheets in the instructional development of percent concepts. In most cases, the use of either poster, chalkboard, or overhead displays is entirely appropriate for presenting charts and grids. Where space permits, then, full-page or large-scale samples are provided to facilitate preparation of either transparencies or copies for distribution to students.

HSPT Skill #19: Fraction/Decimal/Percent Equivalency

The student will be able to convert decimals to percents. The conditions used to construct test items are decimals greater than 1 and less than 1 that are to be converted to percents greater than 100% and less than 100%.

TEST ITEMS

Item #8

Convert 0.73 to a percent.

*A. 73%
B. 7.3%
C. 0.73%
D. 0.0073%

(HSPT, 1984)

Item #56

2.85 = _____%

A. 0.0285
B. 0.285
C. 28.5
*D. 285

(HSPT, 1984)

Item #75

What is 0.067 expressed as a percent?

A. 0.00067%
B. 0.67%
*C. 6.7%
D. 67%

(HSPT, 1984)

Convert percents to fractions. Conditions for testing indicate that knowledge of place value in the base ten system is required. Students are also required to know the equivalent fractions for decimals.

TEST ITEMS

Item #10

20% = _____

A. $\frac{1}{2}$
B. $\frac{2}{5}$
*C. $\frac{1}{5}$
D. $\frac{1}{20}$

(HSPT, 1984)

Item #58

87.5% = _____

A. $8\frac{3}{4}$
*B. $\frac{7}{8}$
C. $\frac{5}{6}$
D. $\frac{8}{75}$

(HSPT, 1984)

Item #77

130% = _____

A. $1\frac{1}{3}$
*B. $1\frac{3}{10}$
C. $\frac{3}{10}$
D. $\frac{13}{100}$

(HSPT, 1984)

*Indicates the correct answer.

• **SKILL #19**

Activity 1 **PERCENT VOCABULARY AND SYMBOL**

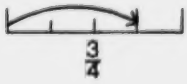
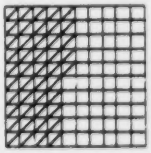
Objective: Students will identify terms, explanations, and examples that are necessary to understand percent in its proper context.

Materials: Chart: Definition of Terms, Vocabulary Check-up

Procedure:

1. Use a prepared transparency of the chart below to review terms, explanations, and symbols.
2. Reinforce terms by covering part of the chart and asking students to supply missing information.
3. Use the vocabulary check-up below to determine students' understanding.

CHART: DEFINITION OF TERMS

Term	Possible Explanation	Examples
fraction	a part of the whole, a portion, part of a group, usually the numerator over the denominator	 $\frac{3}{4}$
decimal	another notation for part of the whole, using place value	2.5
percent	represents parts of one whole in hundredths; denoted by %	 45%

Extension: A) Have students write their own explanations of each term. Then generate a discussion about their explanations.

B) Have students do a pictorial model of each term.

VOCABULARY CHECK-UP

Directions: Match the term or symbol on the left with the statement on the right, and draw an example for each. State the unit and what quantity it represents.

___	1. %	a.	part of the whole, usually expressed as numerator over or divided by denominator
___	2. fraction	b.	another notation for part of a whole, using place value
___	3. percent	c.	hundredths; denoted by %
___	4. decimal	d.	the symbol used with percent

• **SKILL #19**

Activity 2 **PERCENT VOCABULARY - WORD FIND**

Objective: Students will match the corresponding meaning to the following vocabulary words:

tenths	convert	fraction
hundredths	decimal	percent

Materials: Chart: Percent Vocabulary and Word-Find

Procedure:

1. Use the prepared transparency of the Word Find to reinforce terms, and their definitions.
2. Tell students they may come up, circle the word, and give three examples only after reading the meaning of the word aloud. The teacher or a designated student will acknowledge students' raised hands to indicate whose turn it is.
3. Have students write (or draw) examples on the chalkboard.

CHART: PERCENT VOCABULARY:

CONCEPTS

- The unit name given to the digit that occupies the first place to the right of the decimal point
- The unit name given to the digit that occupies that second place to the right of the decimal point
- To change into a different form
- A notation for part of the whole, usually expressed in place value of tenths or hundredths
- Part of the whole in a form that contains a numerator divided by the denominator
- Hundredths, one one-hundredth part or per hundred

WORD FIND

VOCABULARY	D,	E	C	I	P	M	I	L	L	N	C
fraction	M	O	L	D	E	C	I	M	A	L	A
convert	H	U	N	D	R	E	D	T	H	S	H
hundredths	P	F	R	A	C	T	I	O	N	P	I
decimal	V	R	A	T	E	N	T	H	S	E	O
tenths	O	N	T	A	N	D	E	T	P	R	N
percent	N	T	I	O	T	R	E	V	N	O	C
	R	A	O	R	T	I	C	O	N	M	A

• **SKILL #19**

Activity 3 **PARTS OF THE WHOLE**

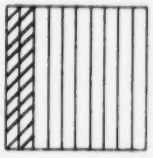
Objective: Students will appropriately name the equivalent values for figures divided into tenths and hundredths.

Materials: Chart: Equivalent Values, Grid Chart

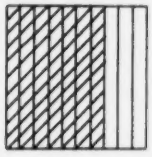
Procedure:

1. Use grids similar to the one on page 10 as examples of tenths and hundredths.
2. Each grid has the value of one whole.
3. Have the students shade part of each grid and name the fraction, decimal, and percent equivalent for each part shaded.
4. Supply students with graph paper and colored pencils.
5. Have students draw the fractional equivalents shown below.
6. Encourage them to discuss and describe what they represented on each grid.

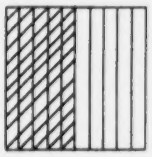
CHART: EQUIVALENT VALUES



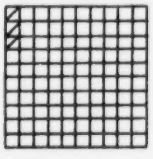
$\frac{2}{10} = .20 = 20\%$



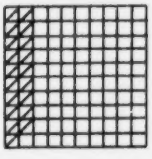
$\frac{7}{10} = .70 = 70\%$



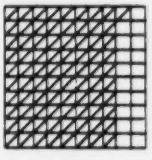
$\frac{5}{10} = .50 = 50\%$



$\frac{3}{100} = .03 = 3\%$



$\frac{19}{100} = .19 = 19\%$



$\frac{81}{100} = .81 = 81\%$

GRID CHART

• **SKILL #19**

Activity 4 **EQUIVALENT PARTS OF THE WHOLE**

Objective: Students will determine that certain parts of a figure divided into ten equal parts are equivalent in size to certain parts of a figure divided into one hundred equal parts.

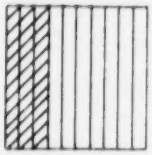
Materials: Chart: Equivalents in Tenths, Chart: Equivalents in Hundredths, Chart: Equivalent Wholes

Procedure:

1. Use prepared transparencies to show equivalents in tenths and equivalents in hundredths.
2. Show each transparency separately, and discuss the figures.
3. Overlay the transparencies to show equivalent parts.
4. Students will recognize that the shaded parts are equivalent.
5. Using a third transparency, try to show different ways to represent one hundred percent.

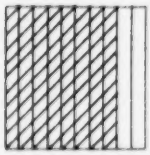
Extension: Ask students to draw another figure and state their unit to name 100%.

CHART: EQUIVALENTS IN TENTHS



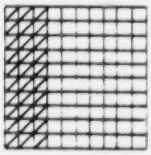
$\frac{3}{10} = .30 = 30\%$

$\frac{5}{10} = .50 = 50\%$

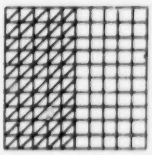


$\frac{8}{10} = .80 = 80\%$

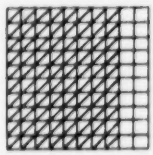
CHART: EQUIVALENTS IN HUNDREDTHS



$\frac{30}{100} = .30 = 30\%$



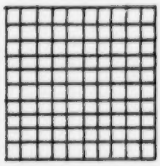
$\frac{50}{100} = .50 = 50\%$



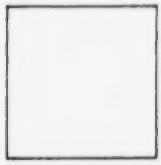
$\frac{80}{100} = .80 = 80\%$

CHART: EQUIVALENT WHOLES

$\frac{10}{10} = 1 = 100\%$



$\frac{100}{100} = 1 = 100\%$



$\frac{1}{1} = 1 = 100\%$

• **SKILL #19**

Activity 5 **NON-EQUIVALENT PARTS**

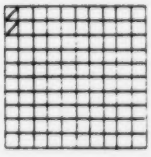
Objective: Students will discuss the differences between percents that are less than ten and percents that are multiples of ten.

Materials: Chart: Non-equivalent Parts

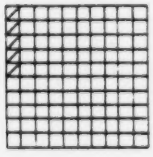
Procedure:

1. Prepare transparencies, as shown in the charts that follow.
2. Show each transparency separately and then together, as an overlay.
3. Generate a group discussion.
4. Guide students to conclude that 2% and 20% are not equal.

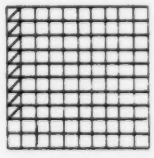
CHART: NON EQUIVALENT PARTS



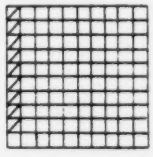
$\frac{2}{100} = .02 = 2\%$



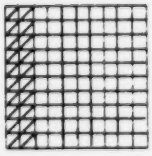
$\frac{5}{100} = .05 = 5\%$



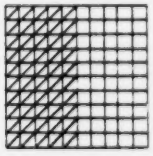
$\frac{8}{100} = .08 = 8\%$



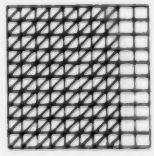
$\frac{9}{100} = .09 = 9\%$



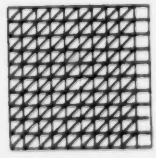
$\frac{20}{100} = .20 = 20\%$



$\frac{50}{100} = .50 = 50\%$



$\frac{80}{100} = .80 = 80\%$



$\frac{90}{100} = .90 = 90\%$

NOTE: Modifications of this activity and others may be used to reinforce concepts for both fractions and decimals.

• **SKILL #19**

Activity 6 **PERCENTS THAT ARE GREATER THAN ONE HUNDRED**

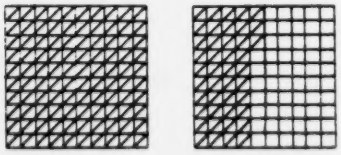
Objective: Students will identify percents that are greater than one hundred.

Materials: Chart: Conversions, markers, graph paper

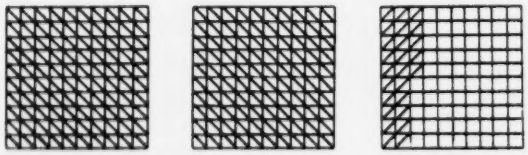
Procedure:

1. Use a transparency to initiate review of the process of conversion from percent to decimal and fraction.
2. Assign students to work in small groups with colored pens and graph paper.
3. Place some examples of percents greater than one hundred on the chalkboard.
4. Have students draw these on graph paper.
5. Encourage them to discuss and describe what is happening in each group.
6. Discuss what are reasonable cases where students would deal with more than 100% in life.

CHART: CONVERSIONS



$\frac{143}{100} = 1\frac{43}{100} = 1.43 = 143\%$



$\frac{225}{100} = 2\frac{25}{100} = 2.25 = 225\%$

• **SKILL #19**

Activity 7 **TWO-MINUTE ESTIMATION**

Objective: Students will use estimation of common fractions in the calculations of percent problems to find reasonable answers.

Materials: Chart: Two-minute Estimation, Estimation Worksheet, the advertisement section a newspaper

Procedure:

1. Generate a discussion about what constitutes reasonable answers.
2. List some percent amounts and some common fractions that are close to these percent amounts.
3. Instruct students in the method of estimation.
4. Provide a chart demonstrating several completed samples and additional problems for students to estimate.
5. Demonstrate the method of solution.
6. Tell students they have two minutes to estimate the remaining answers.
7. Ask students to perform the actual calculations for these problems.
8. Generate a discussion about how reasonable each estimation is to the actual answer.
9. Use the Estimation Worksheet for further practice.

Extension: Use newspapers as a source for more examples. Have students write some word problems and share them with the class.

CHART: TWO-MINUTE ESTIMATION

Problem	Percent to Approximate Common Fraction	Calculation	Estimation	Answer
32% of 120	32% about $\frac{1}{3}$	$\frac{1}{3}$ of 120	40	38.4
49% of $180	49% about $\frac{1}{2}$	$\frac{1}{2}$ of 180	$ 90	$ 88.20
73% of 240	73% about $\frac{3}{4}$	$\frac{3}{4}$ of 240	180	175.2
57% of $300	57% about $\frac{3}{5}$	$\frac{3}{5}$ of 300	$180	$171.
19% of 250				
65% of $333				
11% of 150				
26% of $280				
81% of 350				
39% of $160				

ESTIMATION WORKSHEET

Directions: Circle the answer that is reasonable. Use estimation.

1.	What is 68% of $600?	$408	$40.80	$4.08
2.	What is 39% of 160?	624	6.24	62.4
3.	What is 64% of $270?	$17.28	$1,728	$172.80
4.	What is 81% of 96?	777.6	7.776	77.76
5.	What is 18% of $525?	$94.50	$945.00	$9.45
6.	What is 52% of $888?	$4.61	$46.18	$461.76
7.	What is 26% of 1200?	312	3.12	.312
8.	What is 9% of 710	.639	63.9	6.39
9.	What is 61% of 540	32.94	3.294	329.4
10.	What is 76% of $484	$3.67	$36.78	$367.84

• SKILL #19

Activity 8 **CONVERSION FROM DECIMAL TO PERCENT**

Objective: Students will be able to convert a decimal to a percent.

Materials: Conversion Chart

Procedure:

1. Use the chart to review the place value of tenths and hundredths.
2. Discuss the difference between the ones and tenths place.
3. Engage students in a discussion that leads to the recall of the meaning of the word "percent" (per hundred).
4. Talk the students through the steps in conversion.
5. Use several examples. Give students time to convert.

CONVERSION CHART

Step 1	Step 2	Step 3	Step 4
0.36	36 hundredths	that is 36 parts per hundred	36%
.75	75 hundredths	that is 75 parts per hundred	75%
1.00	100 hundredths	that is 100 parts per hundred	100%
1.35	135 hundredths	that is 135 parts per hundred	135%

• **SKILL #19**

Activity 9 **CONVERSION LOTTO**

Objective: Students will match the percents with their fractional equivalent.

Materials: Conversion Lotto Grid, index cards, fish bowl (or similar container), disks or some small objects such as buttons.

Procedure: This activity is to be conducted like a lottery drawing.

1. Mark index cards with different percent quantities. (Be sure to prepare a card for each fraction you intend to place on the grid.)
2. Make a 5-by-5 grid that contains the fractions corresponding to the percent cards prepared. See the sample grid on page 10.
3. Distribute the lotto grids to students. Then explain that you or a designated student will draw the cards.
4. Place the percent that is written on the index card on display.
5. Allow sufficient time for the students to convert from percent to fraction and to cover the correct answer on their grid with a disk.
6. Draw a second card, and repeat the procedure.
7. Continue until one student has covered "6 winning numbers."

Extension:

A) An option is to make several variations of the grid. This will allow students see that there is no definite pattern to winning.

B) You also may make this into a "Bingo-like" activity. In that case you will continue to draw percent cards until some student has covered fractions in a straight line.

CONVERSION LOTTO GRID

$\frac{1}{2}$	$\frac{1}{3}$	$\frac{5}{12}$	$\frac{6}{9}$	$\frac{15}{10}$
$\frac{1}{10}$	$\frac{3}{8}$	$\frac{9}{10}$	$\frac{3}{25}$	$\frac{350}{100}$
$\frac{1}{4}$	$\frac{1}{12}$	$\frac{3}{10}$	$\frac{83}{100}$	$\frac{1}{100}$
$\frac{3}{5}$	$\frac{7}{12}$	$\frac{110}{100}$	$\frac{7}{10}$	$\frac{22}{25}$
$\frac{2}{25}$	$\frac{7}{8}$	$\frac{3}{50}$	$\frac{4}{5}$	$\frac{9}{4}$

EQUIVALENT PERCENTS ON INDIVIDUAL CARDS

$66\frac{2}{3}\%$	25%	$8\frac{1}{3}\%$	60%	12%
225%	$37\frac{1}{2}\%$	$87\frac{1}{2}\%$	90%	6%
475%	8%	1%	$12\frac{1}{2}\%$	150%
89%	$33\frac{1}{3}\%$	350%	20%	$58\frac{1}{3}\%$
88%	41.6%	40%	10%	70%
50%	110%	80%	83%	30%

• **SKILL #19**

Activity 10 **CONVERSION TIC-TAC-TOE**

Objective: Students will identify the percent equivalents of certain decimals or fractions.

Materials: Conversion Tic-Tac-Toe Grid, a list of corresponding decimal or fraction equivalents

Procedure:

1. Divide students into pairs. One student will place X on the grid. The other student will use the O.
2. Give each pair a list and a grid.
3. Have students take turns converting the fractions and/or decimals into percents and placing their X or O over the correct answer on the grid.
4. Alter the rules to meet the needs of the group.

NOTE: Each worksheet should provide several grids with several groups of corresponding fractions and decimals.

CONVERSION TIC-TAC-TOE GRID

44%	4.2%	75%
92%	15%	90.5%
125%	.5%	.02%

CORRESPONDING FRACTIONS AND DECIMALS

$\frac{1}{200}$	$\frac{21}{500}$	$\frac{3}{20}$
$\frac{11}{25}$	1.25	$\frac{3}{4}$
$\frac{23}{25}$	.905	.0002

Evaluation **FRACTION/DECIMAL/PERCENT EQUIVALENCY**

A) Explain the meaning of the terms and draw a symbol for each.

SYMBOL

1. fraction _____

_____

2. percent _____

_____.

3. tenths _____

_____.

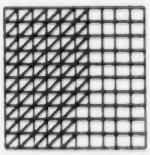
4. decimal _____

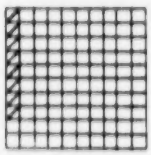
_____.

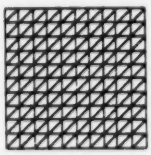
5. hundredths _____

_____.

B) Name the a) fraction, b) decimal, and c) percent represented by each grid.

6. 

7. 

8. 

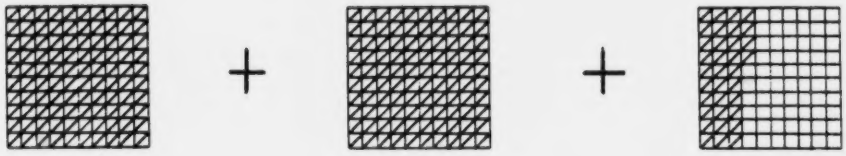
6. a. _____ 7. a. _____ 8. a. _____

b. _____ b. _____ b. _____

c. _____ c. _____ c. _____

C) Name the fraction, decimal, and percent represented in the total of <u>all</u> the grids below.

9.



9._____ _____ _____

D) Complete the Chart on Estimation

Problem	Percent rounded to Common Fraction	Calculation	Estimation	Answer
47% of 600	47% or $\frac{1}{2}$	$\frac{1}{2}$ of 600	300	282
10. 89% of 360				
11. 28% of 93				
12. 77% of 42				

SECTION TWO

COMPUTATION SKILLS

Computation Development For Percent

The first part of this next section presents test items from the computation of percent clusters of the 1984 and 1985 High School Proficiency Tests. The test items and testing conditions are shown as they appear on the HSPT. Some examples from the 1984 and 1985 HSPT are given special attention in a passage entitled, "Diagnostic Information from the HSPT."

The second part of this section provides activities for computation of percents. Some teachers may wish to adapt the applications to the level of instruction appropriate for their students. The use of practical applications, as opposed to rote computation, will foster analytical thinking and problem-solving skills.

Each activity in this section addresses the skills tested in the computation of percents portion of the HSPT. The skill or skills addressed in each appears in bold in the upper right portion of the page. Many activities stress practice of more than one skill.

HSPT Skill #9: Find a Percentage of a Number

The conditions for testing indicate that operations with percents greater than and less than 100 are required.

TEST ITEMS

Item #9

15% of 60 = _____

A. 4
*B. 9
C. 25
D. 40

(HSPT, 1985)

Item #89

What is 300% of 60?

*A. 180
B. 360
C. 500
D. 1800

(HSPT, 1985)

HSPT Skill #10: Find the Percent One Number is of Another

The conditions for testing indicate that operations with percents greater than and less than 100 are required.

TEST ITEMS

Item #10

20 is what percent of 80?

A. 16%
*B. 25%
C. 40%
D. 60%

(HSPT, 1985)

Item #86

60 is what percent of 24?

A. 40%
B. 144%
*C. 250%
D. 400%

(HSPT, 1985)

*Indicates the correct answer.

HSPT Skill #11: Find the Number When a Percentage of that Number is Known

The conditions for testing indicate that operations with percents greater than and less than 100 are required.

TEST ITEMS

Item #11

5 is 125% of what number?

*A. 4
B. 6.25
C. 25
D. 62.5

(HSPT, 1985)

Item #70

120 is 60% of what number?

A. 50
B. 72
*C. 200
D. 720

(HSPT, 1985)

Item #9

36 is 150% of what number?

A. 240
B. 54
*C. 24
D. 12

(HSPT, 1984)

Item #57

20 is 10% of what number?

A. 2000
*B. 200
C. 2
D. 0.2

(HSPT, 1984)

Item #76

15 is 75% of what number?

A. 60
*B. 20
C. 11.25
D. 5

(HSPT, 1984)

*Indicate correct answer.

Diagnostic Information From the HSPT

Consistently, students have demonstrated weak skill development on the computation of percents section of the HSPT. If we look at their common errors, we can gain information about pupils' need for remediation. This section presents the distractors (wrong answers) that students commonly choose. Teachers can examine these errors before planning instruction.

A summary of pupil performance in 1985 on computation of percents indicates weakness in the skill: finding the number when the percent of the number is given. For example, in item #11 on the 1985 HSPT, students' responses indicate the following:

1. 20 percent of the students who responded multiplied the number by the percent. (B)

2. 29 percent divided the percent by the number, but excluded the decimal point. (C)

3. 7 percent multiplied the number by the percent, but misplaced the decimal point. (D)

Item #11

5 is 125% of what number?

*A.	4	43%
B.	6.25	20%
C.	25	29%
D.	62.5	6%

(HSPT, 1985)

The majority of 1984 and 1985 items in the computation of percents cluster required students to convert decimals to percents. In both years, sixty percent or more of the students were able to move the decimal point "two places to the right." On the 1985 HSPT, 60 percent or more of the students were able to find a percentage of a number. On the 1984 HSPT, however, student performance in changing a percent to a fraction was of concern because only 28 percent of those who responded were correct. An analysis of students' responses yielded the following interpretations:

1. 35 percent of the students moved the decimal point one place to the left, put 75 over 100, reduced it, and chose answer $8\frac{3}{4}$. (A)

2. 15 percent of the students randomly chose $\frac{5}{6}$. (C)

3. 21 percent of the students moved the decimal point one place to the left and put 8 over 75 for the response. (D)

Item #58

87.5% = _____

A.	$8\frac{3}{4}$	35%
*B.	$\frac{7}{8}$	28%
C.	$\frac{5}{6}$	15%
D.	$\frac{8}{75}$	21%

Did not respond: 1%

(HSPT, 1984)

*Indicates the correct answer.

An analysis of the errors made on the HSPT helps to clarify student misunderstandings of the concepts presented. Teachers, alerted to the distractors and common errors, can plan instruction that fosters concepts development. Instruction should focus on nurturing critical thinking skills in the solution of computation of percent, as opposed to drills that promote rote memorization.

A Note About the Following Activities

The following activities on computation of percent are presented along with suggested instruction for fostering the comprehension of percent. Some of the activities clearly are dependent on lesson development and serve only as an extension of learning, and not in a capsule form as a drill.

• **SKILLS # 9 and #19**

Activity 11 **GRID COMPUTATION**

Objective: Students will use grids to demonstrate comprehension of percent of a number.

Materials: Chart: Grid Computation, markers, graph paper or worksheets

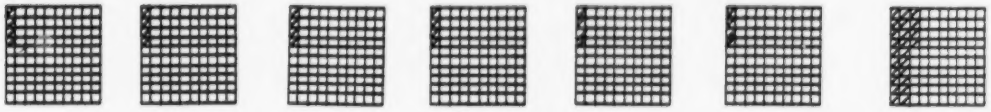
Procedure: Use the sample grid computation to demonstrate the additive nature of finding the percent of a number. Construct a grid with the appropriate number of squares (10-by-10) above each fraction to be added.

NOTE: Prepare several sets of grids using small numbers and at least one using larger numbers. Transparencies with overlays are a good technique.

CHART: GRID COMPUTATION

What is 4% of 6?

1. Show the example as an equation. 4% of 6 =
2. Change 4% to a fraction. $\frac{4}{100}$
3. Color 4 out of 100 little squares on each of the six grids.

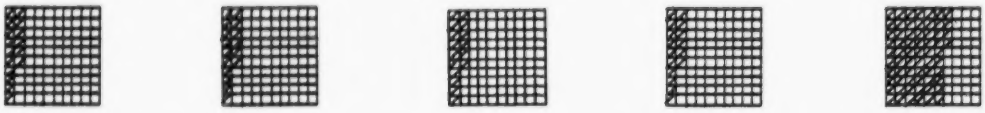


$\frac{4}{100} + \frac{4}{100} + \frac{4}{100} + \frac{4}{100} + \frac{4}{100} + \frac{4}{100} = \frac{24}{100}$

4. Convert $\frac{24}{100}$ to its decimal equivalent. .24

16% of 4 =

1.
2.
3.



$\frac{16}{100} + \frac{16}{100} + \frac{16}{100} + \frac{16}{100} = \frac{64}{100}$

4. $\frac{64}{100} = .64$

• **SKILLS # 9 and #19**

Activity 12 COMPARISONS

Objective: Students will use grids to make comparisons between fractions and percents.

Materials: Grid Comparisons, markers, graph paper or worksheets

Procedure:

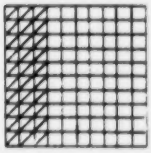
1. List a few common fractions on the chalkboard.
2. In the same manner, list a few percent quantities that are greater than, less than, or equal to the fractions chosen.
3. Provide pairs of prepared grids, 10-by-10, to demonstrate each comparison.
4. For each pair, color one grid so that the fractional portion can be distinguished by the students.
5. For each pair, color the second grid according to the percent quantity.
6. Compare the fractional grids with the percent grids.
7. Encourage the students to discuss the grids used.

Extension: Using graph paper or prepared worksheets, pairs of students can shade grids based on pairs of fractions and percents. They then can compare to determine whether one quantity is greater than, less than, or equal to the other.

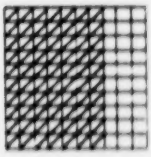
GRID COMPARISONS

Determine $>$, $<$, $=$

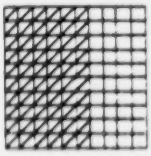
$\frac{1}{5}$



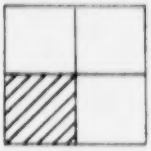
30%



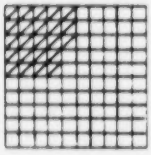
$\frac{7}{10}$



60%

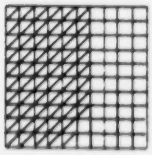


$\frac{1}{4}$



23%

$\frac{1}{2}$



58%

- **SKILLS #9, #10, and #11**

Activity 13 **THE EQUATION OF COMPUTATION**

Objective: Students will compute percentages using the equation form.

Materials: Percent Equation Worksheets for Skills #9, #10, and #11

Procedure:

1. This activity is three-pronged. Begin by introducing the equation in the form "factor x factor = product."
2. Tell students that in percentage problems, two of the numbers are known, and the unknown number will be represented by the variable **n**.

factor x factor = n

n x factor = product

factor x n = product

3. Review the meaning of and process for solving equations.

Extension: Have students make up word problems that correspond to the equations used in this activity.

PERCENT EQUATION WORKSHEET

(Skill #9)

Students will use the first percentage equation to solve the problem.

PROBLEM 1

In New Town, 300 persons attended the game. 25% of those who attended were adults. How many adults attended the game?

Find 25% of 300

$.25 \times 300 = n$

$75 = n$

PROBLEM 2

At Jones School 40% of the seventh grade will take advanced math next year. There are 650 students in seventh grade. How many students will take advanced math next year?

What is 40% of 650?

$.40 \times 650 = n$

$260 = n$

NOTE: Use several examples of this type. At this time students are to be made aware of the fact that the solution of an equation is not necessarily the largest number.

PERCENT EQUATION WORKSHEET
(Skill #10)

Students will use the second percentage equation to solve the problem.

PROBLEM 1

On a Saturday, 60 students volunteered to clean the gym. Six students did not show up. What percentage did not show?

What percent of 60 is 6?

$$n \times 60 = 6$$

$$n = \frac{6}{60}$$

$$n = 10\%$$

PROBLEM 2

For the Science Fair 50 students prepared projects. Astronomy was the topic of 20 of the science projects. What percent of the projects were about astronomy?

20 is what percent of 50?

$$n \times 50 = 20$$

$$n = \frac{20}{50}$$

$$n = 40\%$$

PERCENT EQUATION WORKSHEET
(Skill #11)

Students will use the third percentage equation to solve the problem.

PROBLEM 1

At Hillside School, 30 girls made the varsity and junior varsity basketball team. This is 20% of those who tried out. How many girls tried out?

20% of what number is 30?

$$.20 \times n = 30$$

$$n = \frac{30}{.20}$$

$$n = 150$$

PROBLEM 2

In the walk-a-thon, 40% of the course is 15 meters. What is the distance of the entire walk-a-thon?

Find a number if 40% of it is 15.

$$.40 \times n = 15$$

$$n = \frac{15}{.40}$$

$$n = 37.5$$

NOTE: Reinforcement of this type of equation may be necessary. Depending upon the individual sophistication of the students, practice may be needed far beyond one lesson or a part of a lesson.

• **SKILL #9**

Activity 14 **FORMULA COMPUTATION**

Objective: Students will use the formula p = br to practice computing percentages.

Materials: Formula Computation Worksheets (Steps 1-3)

Procedure:

1. This activity is three-pronged and appropriate only for students familiar with the formula and the meaning of each variable.

$$p = br$$

2. The percent formula is p = br, where

   b is the base,
   r is the rate of percent, and
   p is the percentage.

3. Generate a discussion to determine which quantities are represented in the example or problem and which quantity is unknown.

4. Define the rate of percent as the numerical quantity coupled with the percent sign, or as parts per hundred. The percentage is the portion obtained.

NOTE: Some students may find this approach confusing if they do not know the vocabulary.

FORMULA COMPUTATION

(Skill #9)

Step 1

Students will use the percent formula approach to find the percent of a number.

PROBLEM 1

Ear phones usually sell for $70. On sale, they are reduced by 40%. How much less is the sale price?

Find 40% of 70.

$p = b \times r$

$p = 70 \times .40$

$p = 28$

Answer: $28.00

PROBLEM 2

A dual tape stereo normally costs $263. It has been reduced by 35%. How much less is the reduced price of the dual tape stereo?

What is 35% of 263?

$p = b \times r$

$p = 263 \times .35$

$p = 92.05$

Answer: $92.05

NOTE: Reinforcement should be incorporated into the lesson from a practical source, such as sales from the local newspaper.

Step 2

Students will use the percent formula approach to solve the second type of percentages.

PROBLEM 1

A telephone answering machine sells for $50. It has been reduced by $9. What is the rate of the discount?

9 is what percent of 50?

$$p = b \times r$$

$$9 = 50 \times r$$

$$\frac{9}{50} = r$$

$$18\% = r$$

Answer: 18%

PROBLEM 2

Shoes sell for $60. On sale, they are reduced by $12. What is the rate of the discount?

What percent of 60 is 12?

$$p = b \times r$$

$$12 = 60 \times r$$

$$\frac{12}{60} = r$$

$$20\% = r$$

Answer: 20%

NOTE: Students should practice determining which of the quantities are represented by each variable.

Step 3

Students will use the percent formula to solve the third type of percentages.

PROBLEM 1

At Franklin School 25% of the students bike to school. Seventy students bike to school. What is the total amount of students at Franklin School?

25% of what number is 70?

$$p = b \times r$$

$$70 = b \times .25$$

$$\frac{70}{.25} = b$$

$$280 = b$$

Answer: 280

PROBLEM 2

There are 162 students enrolled in swimming classes. This is 45% of the ninth grade class. What is the total amount of students in ninth grade?

Find a number if 45% of it is 162.

$$p = b \times r$$

$$162 = b \times .45$$

$$\frac{162}{.45} = b$$

$$360 = b$$

Answer: 360

• **SKILLS #10 and #11**

Activity 15 **EQUAL RATIO COMPUTATION**

Objective: Students will use proportions to solve percent problems.

Materials: Equal Ratio Computation Worksheet

Procedure:

1. Review the format of a proportion.
2. State that a proportion involves four numbers. Three of the numbers or their respective variables are stated in the problem. The fourth number always is one hundred and serves as the denominator in the fraction ratio, percent over 100 percent.
3. Explain that one ratio will be percent over percent represented by a fraction.

$$\frac{30}{100} = \frac{n}{50}$$ SIMPLIFY and solve.

$$30 \times 50 = 100\ n$$

$$\frac{30 \times 50}{100} = n$$ Show the process of getting the variable alone.

$$\frac{30}{2} = n$$ SOLVE FOR N.

$$15 = n$$

Extension: Provide examples of each type of percentage equation (see page 34) to reinforce your instruction. Lead students to recognize that the format of the proportion is applicable regardless of the location of the variable n.

EQUAL RATIO COMPUTATION WORKSHEET

(Skills #10 and 11)

PROBLEM 1

In the Jefferson School Drama Club, 30% of the students have performed in community theater. There are 50 students in the Drama Club. How many have performed in community theater?

Find 30% of 50.

$$\frac{30}{100} = \frac{n}{50}$$ Set up the proportion.

PROBLEM 2

There are 50 students in the Jefferson School Drama Club. Of these, 15 have performed in community theater. What percentage of the students have performed in community theater?

$$\frac{n}{100} = \frac{15}{50}$$

PROBLEM 3

Fifteen students in the Jefferson School Drama Club have performed in community theater. Those 15 members represent 30% of the club's membership. How many students in all belong to the club?

$$\frac{30}{100} = \frac{15}{n}$$

Evaluation **COMPUTATION OF PERCENTS**

A. Write each decimal in words, and then convert to a percent.

PERCENT

1) 78.15 _____ _____

_____ _____

2) .43 _____ _____

_____ _____

3) .06 _____ _____

_____ _____

B. Solve the following examples. ANSWERS

4) 6% of 3 = 4) _____

5) 20% of 6 = 5) _____

C. Solve the following.

6) 15% of _____ = 6 6) _____

7) __% of 96 = 30 7) _____

D. Solve the following.

8) 90% of 340 = 8) _____

9) What percent of 80 is 32? 9) _____

E. Set up a proportion, and solve each example.

10) Find 35% of 70. 10) _____

11) Find 20% of 465. 11) _____

12) Find 112% of 26. 12) _____

SECTION THREE

COMPUTATION APPLICATIONS

Computation Applications for Percent

The percents students encounter in their daily lives often are embedded in word problems that require word comprehension and analysis before computation. Preparing students for the percents cluster on the HSPT, then, requires instruction on both computation and word problems. Students are expected to demonstrate mastery of word problems as part of the HSPT. Although this monograph has as its primary focus the computation of percents, that focus includes the application of these skills that is demanded in solving word problems. The chart below presents the items and the clusters from the HSPT Skill Array: Mathematics (1985) that involve the computation of percent.

Computation-Percents Cluster

#9 Find a percentage of a number

#10 Find the percent one number is of another

#11 Find the total number when the percentage of that number is known

Problem Solving Cluster

#39 Solve a percent problem involving sales tax

#40 Solve a percent problem

Number Concepts Cluster

#19 Fraction/decimal/ percent equivalency

Problem Solving Cluster

#38 Compare percent and fraction discount

This third section provides activities which simulate the life situations that require computation of percents.

• **SKILLS #10 and #19**

Activity 16 **PERCENTS OF CIRCLE GRAPHS**

Objective: Students will calculate percents of a circle graph using the information on a graph.

Materials: Chart: Circle Graph I

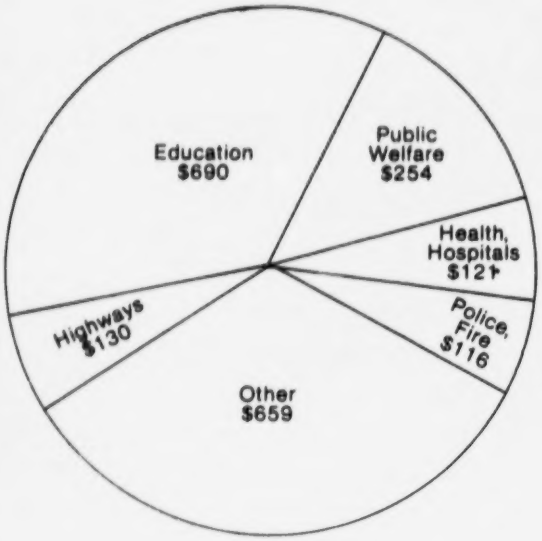
Procedure:

1. Display several circle graphs on the chalkboard or on transparencies.
2. Point to each section of the graph. State what that section represents and the quantity in each section.
3. Demonstrate that when all quantities are added together, the total represents the entire graph, or one hundred percent.
4. Write the quantity represented by each section of the graph in a fraction using the total of all quantities as the denominator.
5. Compute the percent of each "slice" of the circle graph by changing the fractions to decimals and then to percents.

Extension: To reinforce this activity, similar problems can be devised from information provided by social studies or science texts.

CIRCLE GRAPH I

Below is a circle graph that represents what the government of the state of New Jersey spent per person in Fiscal Year 1982.



$	690	Education
	254	Public Welfare
	121	Health, Hospitals
	116	Police, Fire
	659	Other
+	130	Highways
$1,970		or 100% of the graph

SPENDING IN FISCAL YEAR 1982

1. Compute the percent of money spent on each function.

Education	$\frac{690}{1970}$	=	$1970\overline{)690.00}$	=	.35 or 35%
Public Welfare	$\frac{254}{1970}$	=	$1970\overline{)254.00}$	=	.13 or 13%
Health, Hospitals	$\frac{121}{1970}$	=	$1970\overline{)121.00}$	=	.061 or 6.1%
Police, Fire	$\frac{116}{1970}$	=	$1970\overline{)116.00}$	=	.059 or 5.9%
Other	$\frac{659}{1970}$	=	$1970\overline{)659.00}$	=	.33 or 33%
Highways	$\frac{130}{1970}$	=	$1970\overline{)130.00}$	=	.07 or 7%

2. Add up the percent column.

• **SKILL #9**

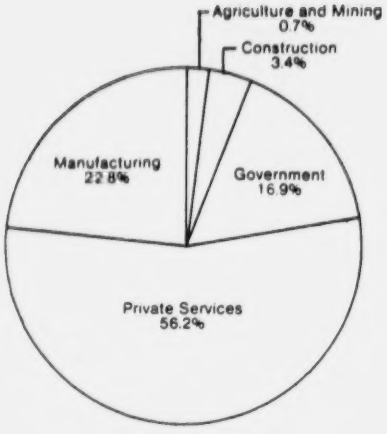
Activity 17 **PERCENTS OF CIRCLE GRAPHS, II**

Objective: Given the total and the percent for each division of the circle graph, students will determine the quantity represented by that percent.

Materials: Chart: Circle Graph II

Procedure:

1. Display several circle graphs on the chalkboard or on transparencies.
2. Divide each graph, and label the divisions with the percentage each represents.
3. Give the students the total that is 100% of the graph. In the sample, the total or 100% is 3,117.
4. Have students calculate the quantity represented by each division.



CIRCLE GRAPH II

SAMPLE

A 1983 survey of employment trends in a particular area of New Jersey showed the percentage of people working in each type of job.

A total of 3,117 people were polled. How many have jobs in each division?

EMPLOYMENT TRENDS

Private Services employs 56.2%

56.2% of 3117
.562 x 3117 = 1751.754 or 1752 people

Manufacturing employs 22.8%

22.8% of 3117
.228 x 3117

Extension: A tie-in to this lesson would be a discussion of the plans students have for future employment.

NOTE: Remind students that they cannot have part of a person; therefore, they will need to round to the nearest whole number.

• **SKILLS #10, #19, and #38**

Activity 18 **DISCOUNT SHOPPING**

Objective: Students will solve word problems which involve computation of percents.

Materials: Chart: Polya's Method, Discount Worksheets

Procedure:

1. Prepare a chart or overhead.

POLYA'S METHOD

Understanding the Problem

Devising a Plan

Carrying Out the Plan

Looking Back

---

2. Conduct a discussion about each step of the method.
3. Review the form of percent computation that is most successful with the instructional level of your students.
4. Present the first word problem to be solved (see Discount Worksheets).
5. Have the students read through the problem silently.
6. Look for any difficulty they may have in comprehending and analyzing the word problem by encouraging them to verbalize their thinking processes.
7. Assist students as they think about the problem by asking probing questions, but do not disclose too much information.
8. Refer to the chart with Polya's Method as a guide to the discussion.
9. Have students think about the format (or number sentence) needed to compute the answer.

10. Have them set up a number sentence. Move about the room to check the mode of operation they intend to use.

11. Have the students compute their answers.

12. Ask them to look back to see if their answer is reasonable.

13. Ask students to talk about the way they solved the problem.

Extension:

A) Use advertisements to generate other problems of interest for the students. Display the advertisements on a bulletin board, and ask the students to "create" their own word problems. Then have them exchange the problems and solve examples.

B) Have students role play the task of comparison shopping.

DISCOUNT WORKSHEET

PROBLEM 1

The Sound Booth sells record albums for $8.97. This week all albums are 30% off. Sam Silly sells their albums for $9.47. Their advertisement states that all albums are 35% off. Which is the better deal and by how much?

Sound Booth	Sam Silly
30% of $8.97 =?	35% of $9.47 =?
.30 x 8.97 =$2.69	.35 x 9.47 = $3.31
$8.97 -2.69 $6.28	$9.47 -3.31 $6.16

$6.28 - $6.16 = $.12

Sam Silly has the better deal by $.12.

DISCOUNT WORKSHEET

PROBLEM 2

Sherman's Sporting Goods normally sells Nike sweat pants for $14.97 and Nike sweat shirts for $16.99. This week the stock of sweat pants and sweat shirts are selling at 40% off the regular price. Silver Medal Sporting Goods has Nike sweat suits that normally sell for $29.99 at 1/3 off the price. Which purchase will save more money and how much will be saved?

Sherman's Sporting Goods

40% of $14.97 = ?	$14.97	$16.99	$ 8.98
.40 x $14.97 = $5.99	- 5.99	- 6.80	+10.19
40% of $16.99 = ?	$8.98	$10.19	$19.17
.40 x $16.99 = $6.80			

or

$14.97 + $16.99 = $31.96	$31.96	
40% of $31.96 = ?	-12.79	
.40 x $31.96 = $12.79	$19.17	

Silver Medal Sporting Goods

$\frac{1}{3}$ of $29.99 = ?	$29.99
.333 x $29.99 = $9.99	- 9.99
	$20.00

$20.00 - $19.17 = $.83

A purchase at Sherman's Sporting Goods will save $.83 over a purchase at Silver Medal.

• **SKILLS #9, #10, #19, and #40**

Activity 19 **APPLYING COMMISSION**

Objective: Students will compute the commission when the rate of commission is known.

Materials: Commission Chart, Chart: Polya's Method (see Activity 18)

Procedure:

1. Review the processes involved in problem solving.
2. Define commission and have several word problems prepared to demonstrate commission to the students.
3. Work through the examples using a technique similar to the procedure in Activity 18.
4. Allow sufficient time for students to solve several problems containing rate of commission.

COMMISSION CHART

PROBLEM 1

Bill has a part-time job at Images Clothing Store. He earns a 3.5% commission on each article he sells. Last week he sold $1,490.00 worth of clothing. How much commission did he earn?

3.5% of $1,490.00 = ?

.035 X 1490 = $52.15

PROBLEM 2

After school, Maria works at Videos Unlimited videotape store. She makes 9% commission on each sale of a videotape. Tapes sell for $27.99. This month, Maria sold 45 videotapes. What is her commission for the month?

9% of $27.99 = ?

.09 x $27.99 = 2.5191

or $2.52

45 x $ 2.52 = $113.40

or

45 x $27.99 = $1,259.55

9% of $1,259.55 = $113.36

PROBLEM 3

Randal needs to save $40.00 a week. He works at C & C Auto Discount Store. His commission is 4%. How much merchandise must he sell to earn at least $40.00 a week?

4% of _____ = $40.00

.04 x n = 40

$$n = \frac{40}{.04}$$

n = $1000.00

- **SKILLS #9, #10, #11, and #40**

Activity 20 **DEPARTMENT STORE PROFIT**

Purpose: Students will determine the increase or markup on items.

Materials: Profit Chart

Procedure:

1. As background for some students, it may be necessary to explain why there is a markup on items. Discuss operation costs and employee salaries, as well as profit. If factory outlets are springing up in your area, the class could discuss the value of that phenomenon to the consumer.

2. Present a chart with columns labeled items, wholesale cost, retail cost, and percent markup. Provide prices for wholesale and retail costs, but leave the percent markup column blank.

3. Solve several examples for the students.

4. Provide time for students to compute the percent of increase for the remaining items.

Extension:

A) This activity can be adapted to any type of percentage computation by alternating the blanks in the wholesale, retail or percent markup columns.

B) Have students create a chart of their own and justify the percent markup for their products.

PROFIT CHART

Schelton's Department Store

Items	Wholesale	Retail	Percent Markup
Men's suits	$ 59.99	$149.38	249%
Tennis shoes	$ 19.50	$ 40.95	210%
VCR's	$150.00	$397.50	
Watches	$149.43	$269.00	
Gloves	$ 21.25	$ 34.85	
Women's coats	$ 49.60	$139.95	
Cordless phones	$ 46.20	$119.79	
Cassette Tapes	$ 2.35	$ 11.00	
Address Books	$ 2.85	$ 6.50	
Televisions	$208.42	$425.00	

- **SKILLS #9, #38, and #39**

Activity 21 **SPECIAL CATALOG SALE**

Objective: Students will compute the discount on items listed in a mail order catalog.

Materials: Catalog items, order forms, directions

Procedure:

1. Distribute copies of catalog pages advertising items that would interest the students.
2. Inform the students that each one has $900.00 to spend on anything in the catalog.
3. Tell students that the company is having a sale on all items and the prices are reduced as follows:
   - Any item less than $10.00 is 10% off.
   - Any item priced between $10 and $49.99 is 15% off.
   - Any item priced between $50 and $79.99 is 20% off.
   - Any item priced between $80 and $119.99 is 25% off.
   - Any item greater than $120 is 30% off.
4. Inform the students they are to spend as much of the $900 as possible without spending over the amount. If they overspend they loose all of the money.
5. Distribute the order forms, and ask students to complete the form correctly, making sure they include sales taxes, shipping, and insurance costs. Remind students that these additional charges are included in the total amount they are allowed to spend.

Extension: Assign a student the role of catalog clerk to take orders and add up the bill total. Have students take turns phoning in their orders to the catalog clerk. Encourage students to be attentive to overspending.

NOTE: This activity could be adapted to a small group activity for reinforcement.

• **SKILLS #9, and #39**

Activity 22 **SALES TAX**

Objective: Students will compute the amount of sales tax on items purchased.

Materials: Sales Tax Worksheets, Chart: Polya's Method (see Activity 18), the advertisement section of a newspaper

Procedure:

1. Review the processes involved in problem solving.
2. Present problems that require sales tax computation.
3. Work through the sample problems using a technique similar to the procedure in Activity 19.
4. Explain that these problems have more than one step.
5. Allow sufficient time for students to solve several problems requiring sales tax computation.
6. Use samples of problems that ask for change or a savings.

Extension: Have students write problems of each type and pass them to a classmate for solutions. Encourage discussion.

SALES TAX WORKSHEETS

PROBLEMS 1

Jason is going to replace his old camping equipment. He intends to purchase the following:

back pack	$ 44.00	sportsman's knife	$19.00
sleeping bag	$119.00	Coleman stove	$69.00
tent	$116.00	compass	$ 8.00
camp lantern	$ 26.00	utensils	$24.00

What will be the total spent if the sales tax in New Jersey is 6%?

$ 44.00
119.00
116.00
26.00
19.00
69.00
8.00
+ 24.00
$425.00

Sales tax is 6%

$425.00
x.06
$ 25.50

Total

$425.00
+25.50
$450.50

Total cost to replace equipment is $450.50

PROBLEM 2

In the L.L. Bean catalog from the state of Maine the price of each piece of equipment is the same, but the sales tax is 5%. There is no charge for delivery. How much will Jason save if he orders the equipment from Maine?

Cost of items is $425.00
Sales tax for Maine is 5% x.05
$ 21.25

Total

$425.00
+21.25
$446.25

Difference between New Jersey and Maine

$450.50 NJ
-446.25 Maine
$ 4.25 Savings

PROBLEM 3

Mariana is preparing to enter a biking competition. She needs a helmet @$49.00, goggles @$19.00, Nike formfitting suit @$166.00 and Nike bootees @$42.00. The sales tax is 6%. She has $589.54 in her savings account. How much will she have left in the account if she withdraws just enough to pay for the items and the tax?

$ 49.00	New Jersey sales tax 6%	
19.00		
166.00	$276.00	$276.00
+42.00	x.06	+16.56
$276.00	$ 16.56	$292.56

The amount left in savings in $589.54 - 292.56 = $296.98.

• **SKILLS #9 and #39**

Activity 23 **TAX AND TIPS**

Objective: Students will compute the amount of tip.

Materials: Chart: Tax and Tips, worksheets, menus from local eateries

Procedure:

1. Prepare several sample checks from the menus.
2. Calculate the sales tax using a technique similar to the activity on sales tax.
3. Explain that these are multi-step solutions.

Extension: Students can create the name of a restaurant and develop a menu to be placed on the chalkboard. Word problems can then be constructed and solved using the procedures in this activity either as a group or individually.

Try some "mental math" tasks with the students. Put a few food bill totals on a chart. Have students estimate what it would cost each person if there were three, four, five, and six people sharing the bill equally.

CHART: TAX AND TIPS

PROBLEM 1

After skating, friends went out for lunch. They ordered the following items:

1 Italian Sub (Hoagie)	$2.25
2 Cheesesteak Hoagies	$3.25 each
1 Cheese Sub	$1.95
1 California Burger	$2.65
5 Large cokes	$ .70 each

Calculate the total cost including 6% sales tax and a 15% tip for the server.

PROBLEM 2

Six friends went out for pizza. Calculate what each person must pay if the total cost, tax, and tip were divided equally among the six.

This is the order:	1 large pepperoni pizza	$8.75
	1 large mushroom pizza	8.50
	1 large extra-cheese pizza	6.95
	6 large colas	4.50

Total..... _____

Tax 6%..... _____

Tip 15%..... _____

Cost per person..... _____

- **SKILLS #10 and #40**

Activity 24 **SHARE OF PROFIT**

Objective: Students will compute the share of profit earned by investors.

Materials: Profit Worksheet

Procedure:
1. Prepare several problems.
2. Set up a chart or table to facilitate solutions.
3. Complete the chart or table with students.

PROFIT WORKSHEET

PROBLEM

Mr. Wright and Mr. Stapleton are business partners. They agreed to share their profits according to the percent of their investment. The following table was developed to illustrate their investments. Complete the chart.

INVESTMENT TABLE

Total Investment		Percent of Investment		Share of Profit		
Wright	Stapleton	Wright	Stapleton	Profit	Wright	Stapleton
$14,000	$ 6,000	70%	30%	$8,000	$5,600	$2,400
$ 8,000	$12,000			$9,000		
$ 9,000	$18,000			$6,300		

• **SKILLS #9 and #19**

Activity 25 **CALCULATING TIPS USING ESTIMATION**

Objective: Students will use estimation to calculate tips.

Materials: Calculating Tips Worksheet I

Procedure:

1. Prepare a chart, similar to the ones that follow, with columns for food bills, estimation, percent, and tip.
2. Tell students to round food bills to the nearest dollar. If necessary, review estimation to the nearest dollar.
3. Have students convert the percent to a common fraction.
4. Have students multiply the dollar amount by the common fraction and complete the chart.

CALCULATING TIPS WORKSHEET I

A.	Food Bill	Estimation	15%	Tip
	$5.84	$6.00	$\frac{3}{20}$	$.90
	$4.75		$\frac{3}{20}$	

B.	Food Bill	Estimation	15%	Tip
	$5.84	$6.00	$\frac{1}{5}$	$1.20
	$4.75		$\frac{1}{5}$	

Explanation

A. The food bill is $5.84:

15% of $5.84 =

$5.84 is about $6.00...rounded to the nearest dollar

$15\% = \frac{15}{100} = \frac{3}{20}$ - - - - - - equivalent fraction

15% of $6.00 = - - - - - estimation to nearest dollar

$\frac{3}{20} \times \$6.00 = \$.90$ - - - - estimated tip

B. 20% of $5.84 =

$5.84 is about $6.00....rounded to the nearest dollar

$20\% = \frac{20}{100} = \frac{1}{5}$ - - - - - - - - equivalent fraction

20% of $6.00 - - - - - - - estimation to nearest dollar

$\frac{1}{5} \times \$6.00 = \$1.20$ - - - - estimated tip

Chart for Tips

Food Bill	Estimation	15%	20%
$19.81	$20.00	$3.00	$4.00
$ 7.41	$ 7.00	$1.05	$1.40
$ 3.64	$ 4.00	$ .60	$ .80

• **SKILLS #9 and #19**

Activity 26 **CALCULATING TIPS USING ESTIMATION FOR 15%**

Objective: Students will use estimation and addition to calculate tips.

Materials: Calculating Tips Worksheet II

Procedure:

1. Prepare a chart similar to the one that follows.
2. Have students rename 15% as 10% + 5%.
3. Estimate the food bills to the nearest dollar amount.
4. Find 10% of that dollar amount.
5. Take 1/2 of that 10% tip from step 4 (1/2 of 10% is 5%).
6. The sum of the answers from steps 4 and 5 is the estimated tip.

CALCULATING TIPS WORKSHEET II

Food Bill	Estimation	10%	1/2 of 10% or 5%	Total Tip
$6.80	$7.00	.70	.35	$1.05
$4.35	$4.00			

Explanation: The food bill is $6.80:

15% of $6.80 =

15% = 10% + 5% - - - - - - - - - rename
$6.80 is about $7.00 - - - - - round to nearest dollar
10% of $7.00 = .70
5% of $7.00 = .35 - - - - - - - 5% is one half of 10%

1/2 of .70 = .35
.70 + .35 = 1.05 - - - - - - - - estimated tip

Chart for Tips

Food Bill	Estimation	10%	1/2 of 10% or 5%	Total Tip
$ 6.87	$ 7.00	.70	.35	$1.05
$ 9.14	$ 9.00	.90	.45	$1.35
$18.90	$19.00	1.90	.95	$2.85

• **SKILLS #9 and #19**

Activity 27 **CALCULATING TIPS USING ESTIMATION FOR 18%**

Objective: Students will use estimation and multiplication to calculate tips.

Materials: Chart: Calculating Tips from Sales Tax

Procedure:

1. If a 15% tip is too low and a 20% tip is too high then an 18% tip may be a good estimation.
2. A tip of 18% of the food bill can be calculated by multiplying the sales tax of 6% by 3.

CHART: CALCULATING TIPS FROM SALES TAX

If a food bill is $4.50, a 6% sales tax is $.27. The 18% tip is 3 x .$27 or $.81.

$4.50 x .06 = .27

3 x .27 = .81

If a food bill is estimated to be $9.00, a 6% sales tax is $.54. The 18% tip is 3 x .$54 or $1.62.

$ 9.00 x .06 = .54

3 x .54 = 1.62

If a food bill is estimated to be $14.50, a 6% sales tax if $.87. The 18% is 3 x $.87 or $2.61.

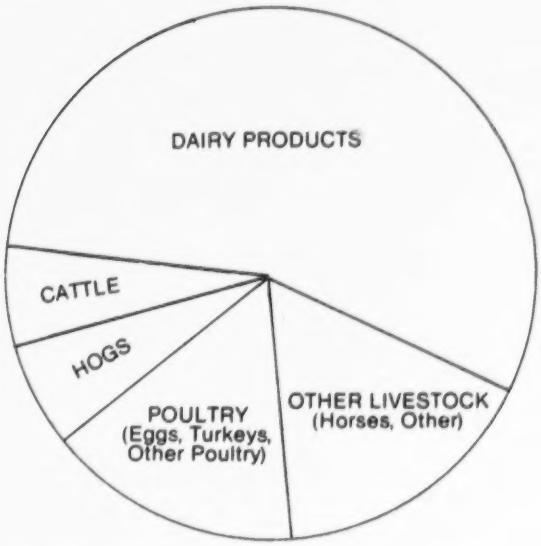
$14.50 x .06 = .87

3 x .87 = 2.61

Evaluation **COMPUTATION APPLICATIONS FOR PERCENTS**

A) Compute the percent of money earned from New Jersey livestock sales in one year.

1983 New Jersey Livestock Earnings



DAIRY PRODUCTS
$70,000,000

HORSES
$21,000,000

POULTRY
$19,000,000

CATTLE
$7,000,000

HOGS
$8,000,000

1) Dairy Products = _____%

2) Cattle = _____%

3) Hogs = _____%

4) Poultry = _____%

5) Horses = _____%

B) Using the items listed below, find the sale price or percent of discount.

6) Tri-color gold chain @ $299.49 is 40% off. Sale price _____.

7) Pro Style Hair Dryer #1250 was $13.99; is now $6.99. Percent of discount _____.

8) Memorex Video Cassettes now $3.99 were $7.99. Percent of discount _____.

9) Polaroid 600 Camera @ $59.99 is 30% off. Sale price _____.

10) Texas Instruments Light-Powered Calculator was $8.99; is now $5.99. Percent of discount _____.

C) Estimate the tip.

Food Bill	Estimation to dollar	15%	18%	20%
11) $ 9.89				
12) $13.46				
13) $21.92				

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FEEDBACK FORM

Improving Mathematical Skills Assessed on the High School Proficiency Test

Computation of Percents

The Department of Education would appreciate your reaction to this document. Please answer the questions below after you have used this document for more than four weeks. You may photocopy this form for your response.

Teaching Assignment or Title _____

Grade Level ____ Years Teaching ____

Number of Years Teaching Primarily Math _____

Certification(s) _____

A. How did you obtain this resource book?

____	Workshop	____	Other Teacher
____	Central Office	____	Other _____
____	Principal		

B. What training (assistance) did you receive in the use of this document? Would you like to have additional training?

C. Please describe any <u>specific</u> changes you have made in teaching percents as a result of using this resource book.

D. What specific changes if any, would you recommend for this resource book? Cite specific activities.

E. With whom have you shared this resource book?

_____ Teacher(s) (specify grade level __)

_____ Principal/supervisor

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Other(s) _____

F. Other observations and remarks:

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